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The Principle of Long-Distance Rockets

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A number of letters have come to the editors asking for an explanation of the principle of rockets. The technology of rockets is at present a separate field, and its development is leading in two directions. On the one hand this technology serves military purposes, and on the other it works for civilian research. Rockets are accorded a great future as a transport medium. Our readers have surely read about experiments on the use of rocket power for transporting the mails as well as for research on the stratosphere.

The principle of all rocket power is in the expansion of gases which, trying to overcome their internal pressures, develop pressure on all sides. When they are enclosed in a solid cylinder and can escape only in one direction, there develops in the opening to the cylinder a reactive pressure which pushes the cylinder in the opposite direction from that in which the gases are escaping. This is the simplest possible explanation, and a detailed technical study would require an involved explanation.

Long-distance rockets consist of gigantic, slender cylinders, in order to develop a sufficient quantity of gases. Inside they contain reservoirs full of liquid oxygen and alcohol. Instead of alcohol other liquids can be used, all highly inflammable. The liquids from both containers flow through openings into the combustion chamber, where they burn at high temperatures, and the gaseous products rush at enormous speeds through nozzles out into free space. Such rockets, weighing up to 20 tons, fly up to 25 to 30 kilometers high, and their flight is controlled by an ultra-high frequency transmitter. Rockets used for research on the upper regions, as for example research on the ionosphere or on cosmic rays, carry in their heads measuring instruments, which are saved in landing by means of a parachute system.

The picture shows such an experimental rocket for research on the higher regions. [The numbers refer to numbers on the picture.]

1. Space for experimental instruments.
2. Space for electric batteries which drive the electric instruments.
3. Steel plate cutting off the head.
4. Steel container for controlling instruments for the rocket.
5. Location of explosives which throw off the head of the rocket.
6. Radio fuses for the above explosives.
7. Compound parachute.
8. Container for liquid oxygen.
9. Opening for fuel;

/10.?/ Space for machinery and control organs.

11. Turbine containing fuels.
12. Duct to nozzle.
13. Combustion chamber.
14. Guiding fin.
15. Protective wall for nozzle.
16. Protective wall for batteries.
17. Receive for control signals.
18. Storage batteries.
19. Mechanical equipment for radio signals.
20. Automatic mechanism.
21. Large parachute to save control equipment.
22. Container for alcohol.
23. Openings for alcohol.
24. Pipe in which the fuels mix.
25. Outer covering of the rocket.
26. Starting fuse.
27. Organs for directing the delivery of fuel.
28. Automatic control of fuel consumption.
29. Instrument for continuous combustion of fuels.
30. Directing device for gas pressures.
31. Electric equipment for moving guiding fin.

As can be seen from the diagram the equipment for long-distance rocket flight is by no means simple. The instruments must work extremely precisely, since an error measured in thousandths of millimeters or in thousandths of seconds may mean a large error in flight. Even so in a number of trials the rocket, even with the greatest care, changes direction so sharply that right at the start it turns toward the earth, and, after crashing, explodes dangerously. And then the enormous expenses of the trial are lost. For this reason even the well-known German V-2 weapon was effective only to a small percent, since it was difficult to control and seldom reached its goal.

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